IOI Training Camp 2014 – Test 3, 4 May, 2014

Cake

You are organizing a party and have bought several pieces of cake for it. You know the weights of each of these pieces.

After looking at the pieces more carefully, you became worried that they have different weights and decided to make these differences smaller. In order to do this, you can make at most `maxCuts` cuts. With each cut you can choose one of the pieces you currently have and divide it into two pieces. Note that each of these two pieces can be chosen again when making subsequent cuts.

Your goal is to produce cuts in such way that the difference between the maximum and the minumum pieces' weights becomes as small as possible. Find the best way of making cuts and return the optimal difference.

Input format

- First line contains 2 integers, `n` and `maxCuts`. `n` is the number of cake pieces at the beginning.
- The second line contains `n` space separated integers, which are the weights of the `n` pieces.

Output format

Output one number, which is the optimal difference. Your output value must have an absolute or relative error less than `1e-6`.

Test data

Each of the weights will be an integer between 1 and 10^6, inclusive. `maxCuts` will be an integer between 1 and 10^5, inclusive.

Subtask 1 (40 Marks) $1 \leq \texttt{n} \leq 50$

Subtask 2 (20 Marks) $1 \leq \texttt{n} \leq 1000$

Subtask 3 (40 Marks) $1 \leq \texttt{n} \leq 10^6$

Sample input 1

```
2 2
1 3
```

Sample output 1

```
0
```

Explanation

First, choose the piece with weight 3 and cut it into pieces with weights 1 and 2. Then, choose the piece with weight 2 and cut it into two pieces with weight 1. Now all pieces have the same weight, so the answer is 0.

Sample input 2

```
5 4
1 1 1 1 1
```

Sample output 2

```
0
```

Explanation

Even though you are allowed to make 4 cuts, there is no sense in making any of them.

Sample input 3

```
2 1
1 3
```

Sample output 3

```
0.5
```

Explanation:

The same case as in example 0, but now you are allowed to make only one cut. The best thing to do is to cut the piece with weight 3 into two pieces with weights 1.5.

Sample input 4

```
3 10
7 11 13
```

Sample output 4

```
0.3999999
```

Sample input 5

```
5 27
13 69 41 37 80
```

Sample output 5

```
1.4666666
```